SUCTION VALVE ASSEMBLY OF RECIPROCATING COMPRESSOR

BACKGROUND OF THE INVENTION

1. Field of the Invention

The present invention relates to a suction valve assembly of a reciprocating compressor, and more particularly, to a suction valve assembly of a reciprocating compressor capable of enhancing a reliability of a compressor by preventing a damage due to a fatigue of a suction valve.

2. Description of the Conventional Art

Generally, a compressor is divided into a rotary compressor, a reciprocating compressor, a scroll compressor, and etc. according to a fluid compression method.

Figure 1 is a sectional view of a reciprocating compressor in accordance with the conventional art.

The conventional reciprocating compressor comprises: a hermetic case 106 to which a suction pipe 102 and a discharge pipe 104 are connected; a reciprocating motor 108 disposed in the case 106 for generating a reciprocation force; a compressing unit 110 for compressing a fluid by receiving the reciprocation force generated from the reciprocating motor 108; and frames 132, 134, and 136 for supporting the reciprocating motor 108 and the compressing unit 110.

The reciprocating motor 108 includes: an outer stator 118 having a cylindrical shape and on which a coil 122 is wound therein; an inner stator 120 disposed at an inner circumferential surface of the outer stator 118 with a certain air gap; and a magnet 124 disposed between the outer stator 118 and the inner stator 120 with a certain interval for performing a linear reciprocation when a power is applied to the coil 122.

The magnet 124 is fixed to an outer circumferential surface of a magnet holder 126 with the same interval, and the magnet holder 126 is connected with a piston 128 of the compressing unit 110.

A first resonant spring 138 and a second resonant spring 140 are respectively disposed between both side surfaces of the magnet holder 126 and the frames 132 and 136, thereby inducing a resonant movement of the piston 128.

The compressing unit 110 is constituted with the piston 128 connected to the magnet holder 126 and linearly-reciprocated; a cylinder 144 into which the piston 128 is slidably inserted, forming a certain compression chamber 140, and fixed to the first frame 132; a suction valve 148 for opening and closing a suction hole mounted at the front side of the piston 128; and a discharge valve assembly 150 mounted at the front side of the cylinder 144 for discharging a fluid inside the compression chamber 142 to outside through the discharge pipe 104 when a pressure inside the compression chamber 142 is more than a preset pressure.

The piston 128 is provided with a suction passage 152 at the center thereof, the suction passage formed in a longitudinal direction and through which a fluid is sucked. The piston 128 is also provided with a suction hole 154 at the front side thereof, the suction hole for supplying the fluid introduced into the suction passage 152 to the compression chamber 142. Also, a bolt coupling groove 158 to

which the suction valve 148 is bolt-coupled is formed at the center of the front side of the piston 128.

As shown in Figure 2, the suction valve 148 is formed as a disc shape having a certain elastic force, and one side thereof is fixed to the front surface of the piston 128 by a bolt 160.

That is, the suction valve 148 is composed of a fixed portion 164 having a bolt hole 162 at the center thereof and fixed to the center of the front surface of the piston 128 by the bolt 160; and an open/close portion 166 cut as a curved line form on the basis of the fixed portion 164 for opening and closing the suction hole 154.

Figures 3 and 4 are sectional views showing an operational state of the suction valve in accordance with the conventional art.

In the suction valve of the reciprocating compressor in accordance with the conventional art, when the reciprocating motor 1087 is driven, the magnet 124 is linearly-reciprocated and thereby the piston 128 connected to the magnet 124 is linearly-reciprocated thus to compress a fluid.

That is, as shown in Figure 3, when the piston 124 is retreated, the open/close portion 166 of the suction valve 148 is widened at the front side of the piston 124 by a pressure of the fluid thus to open the suction hole 154, thereby supplying the fluid introduced into the suction passage 152 of the piston 124 to the compression chamber 142.

Under this state, when the piston 124 advances for the compression of the fluid according to the driving of the reciprocating motor 108, the suction valve 148 is adhered to the front surface of the piston 124 by its own elastic force thus to close the suction hole 154. Also, when the pressure inside the compression

chamber 142 is more than a preset pressure accordingly as the piston 128 advances more, the discharge valve 150 is opened thus to discharge the fluid compressed in the compression chamber 142 to outside.

However, the suction valve of the reciprocating compressor in accordance with the conventional art has a thin disc shape, and the open/close portion is elastically transformed on the basis of the fixed portion fixed to the piston thus to open and close the suction hole. According to this, if the open/close portion performs the open/close operation continuously, the suction valve is damaged due to fatigue or excessive openings thereby to lower a reliability of the product.

Also, since the suction valve performs the open/close operation by being elastically transformed, a responsiveness due to excessive open/close operations is lowered.

Additionally, since the suction valve is bolt-coupled to the front side surface of the piston, a dead volume is generated in the compression chamber thus to lower a compression efficiency.

SUMMARY OF THE INVENTION

Therefore, an object of the present invention is to provide a suction valve assembly of a reciprocating compressor capable of preventing a suction valve from being damaged due to fatigue by preventing the suction valve from being excessively opened and thereby enhancing a reliability of the compressor, in which the suction valve is opened and closed by a rotation movement and a linear-reciprocation.

Another object of the present invention is to provide a suction valve

assembly of a reciprocating compressor capable of enhancing a responsiveness of a suction valve according to an open/close operation by preventing the suction valve from being excessively opened.

Still another object of the present invention is to provide a suction valve assembly of a reciprocating compressor capable of enhancing a compression efficiency by minimizing a dead volume existing in a compression chamber where a fluid is compressed.

To achieve these and other advantages and in accordance with the purpose of the present invention, as embodied and broadly described herein, there is provided a suction valve assembly of a reciprocating compressor comprising: a valve supporting body inserted-fixed to a valve mounting portion formed at a piston and provided with at least one suction hole through which a fluid introduced into a suction passage of the piston is supplied to a compression chamber of a cylinder; and a suction valve mounted at the valve supporting body to be rotatable within a certain range, for opening and closing the suction hole formed at the valve supporting body.

The valve supporting body is formed as a disc shape, a circumferential surface thereof is fixed to the valve mounting portion, and the valve supporting body is provided with a pin hole into which a hinge pin is inserted so that the suction valve can be hinge-coupled. At least one suction hole is formed at one side on the basis of the pin hole of the valve supporting body, and a stopper for preventing the suction valve from being opened more than a certain range by stopping the suction valve is formed at another side.

The suction valve has a disc shape, and is provided with a slot at the center thereof, the slot into which the hinge pin is inserted. The suction valve is

provided with an open/close portion formed at one side on the basis of the slot for opening and closing the suction hole of the valve supporting body, and is provided with a stopping portion formed at another side on the basis of the slot and stopped by the stopper of the valve supporting body.

The foregoing and other objects, features, aspects and advantages of the present invention will become more apparent from the following detailed description of the present invention when taken in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

The accompanying drawings, which are included to provide a further understanding of the invention and are incorporated in and constitute a part of this specification, illustrate embodiments of the invention and together with the description serve to explain the principles of the invention.

In the drawings:

Figure 1 is a sectional view of a reciprocating compressor in accordance with the conventional art;

Figure 2 is a disassembled perspective view of a suction valve in accordance with the conventional art;

Figures 3 and 4 are sectional views showing an operational state of the suction valve in accordance with the conventional art;

Figure 5 is a sectional view of a reciprocating compressor according to the present invention;

Figure 6 is a disassembled perspective view of a suction valve assembly

according to the present invention; and

Figures 7 and 8 are sectional views showing an operational state of the suction valve assembly according to the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

Reference will now be made in detail to the preferred embodiments of the present invention, examples of which are illustrated in the accompanying drawings.

Hereinafter, one embodiment of a suction valve assembly of a reciprocating compressor according to the present invention will be explained with reference to attached drawings.

Even though a plurality of preferred embodiments of the suction valve assembly of a reciprocating compressor according to the present invention can exist, the most preferred embodiment will be explained.

Figure 5 is a sectional view of a reciprocating compressor according to the present invention.

The reciprocating compressor according to the present invention comprises: a case 6 having a certain hermetic space and to which a suction pipe 2 for sucking a fluid and a discharge pipe 4 for discharging a compressed fluid are connected; a reciprocating motor 8 disposed in the case 6 for generating a reciprocation force when a power is applied; a compressing unit 10 for compressing a fluid by receiving the reciprocation force generated from the reciprocating motor 8; and frames 12, 14, and 16 for supporting the reciprocating motor 8 and the compressing unit 10.

The reciprocating motor 8 includes: an outer stator 18 having a cylindrical

shape and wound by a coil 22 therein; an inner stator 20 disposed at an inner circumferential surface of the outer stator 18 with a certain air gap; and a magnet 24 reciprocatingly disposed at the air gap between the outer stator 18 and the inner stator 20.

The magnet 24 is fixed to an outer circumferential surface of a magnet holder 26 with the same interval, and the magnet holder 26 is connected with a piston 30 of the compressing unit 10.

A first resonant spring 48 and a second resonant spring 50 are respectively disposed between one side surface of the magnet holder 26 and the frame 12 and between another side surface of the magnet holder 26 and the frame 16, thereby inducing a resonant movement of the piston 30.

The compressing unit 10 is constituted with the piston 30 connected to the magnet holder 26 and reciprocated, a cylinder 34 into which the piston 30 is slidably inserted and forming a certain compression chamber 32, a suction valve assembly 38 for opening and closing a suction hole mounted at the front side of the piston 30, and a discharge valve assembly 40 mounted at the front side of the cylinder 34 for discharging a compressed fluid to outside when a pressure inside the compression chamber 32 is more than a preset pressure.

The piston 30 is provided with a suction passage 51 penetratingly formed in a longitudinal direction through which a fluid is sucked. Also, a valve mounting portion 52 for mounting the suction valve assembly 38 is formed at an inner circumferential surface of the front side of the piston 30.

The suction valve assembly 38, as shown in Figure 6, includes: a valve supporting body 60 inserted-fixed to the valve mounting portion 52 formed at the piston 30 and provided with at least one suction hole 54 through which a fluid

introduced into the suction passage 51 of the piston 30 is supplied to the compression chamber 32 of the cylinder 34; and a suction valve 70 mounted at the valve supporting body 60 to be rotatable within a certain range, for opening and closing the suction hole 54 formed at the valve supporting body 60.

The valve supporting body 60 is formed as a disc shape and a circumferential surface thereof is inserted-fixed to the valve mounting portion 52. A pin hole 62 for inserting a hinge pin 80 so that the suction valve 70 can be hinge-coupled to the valve supporting body 60 is formed at the center of the valve supporting body 60 in a diameter direction. The suction hole 54 is formed at one side on the basis of the pin hole 62 of the valve supporting body 60, and a stopper 64 for preventing the suction valve 70 from being opened more than a certain degree is formed at another side.

The stopper 64 of the valve supporting body 60 is formed to have a certain inclination surface of which height becomes lower towards the edge from the center of the valve supporting body 60.

The suction valve 70 has a disc shape, and is provided with a slot 72 rotatably supported at the valve supporting body 60 and to which the hinge pin 80 is inserted. The suction valve 70 is provided with an open/close portion 74 protruded at one side on the basis of the slot 72 with a certain height and adhered to one side surface 66 of the valve supporting body 60 where the suction hole 54 is formed, and is provided with a stopping portion 76 stopped by the stopper 64 of the valve supporting body 60 for restricting an opening angle of the open/close portion 74.

The slot 72 of the suction valve 70 is formed to be rotated when the suction valve 70 is opened, and has a certain length so as to be linearly-moved

towards the longitudinal direction of the piston 30. The open/close portion 74 of the suction valve 70 is formed to have a height higher than that of the stopping portion 76.

The valve mounting portion 52 of the piston 30 is provided with a valve seat portion 82 at an upper inner circumferential surface thereof, to the valve seat portion 82 an outer circumferential surface of the suction valve 70 is hermetically adhered. The valve seat portion 82 is preferably formed as a certain curved surface form so that the suction valve 70 can be rotated. The outer circumferential surface of the suction valve 70 is also formed as a curved surface form corresponding to the valve seat portion 82 so that the suction valve 70 can be slid by being in surface-contact with the valve seat portion 82.

Operation of the reciprocating compressor according to the present invention will be explained as follows.

Figures 7 and 8 are sectional views showing an operational state of the suction valve assembly according to the present invention.

When the reciprocating motor 8 is operated, the magnet 24 is linearly-reciprocated and the piston 30 connected to the magnet 24 is linearly-reciprocated thus to compress a fluid.

Operation for compressing a fluid will be explained in more detail. As shown in Figure 7, once the piston 30 is retreated, the suction valve 70 is opened by a pressure difference between a fluid introduced into the suction passage 51 of the piston 30 and the compression chamber 32 of the cylinder 34. That is, the suction valve 70 is rotated on the basis of the slot 72 into which the hinge pin 80 has been inserted, and the open/close portion 74 of the suction valve 70 is separated from the suction hole 54 formed at the valve supporting body 60 by

being linearly-moved along the slot 72, thereby opening the suction hole 54. According to this, the fluid of the suction passage 51 of the piston 30 is supplied to the compression chamber 32 of the cylinder 34 through the suction hole 54.

At this time, the stopping portion 76 of the suction valve 70 is stopped by the stopper 64 formed at the valve supporting body 60 thus to restrict an opening angle of the suction valve 70, thereby preventing the suction valve 70 from being excessively opened.

Under this state, when the piston 30 advances as shown in Figure 8, the suction valve 70 is closed and thereby the fluid inside the compression chamber 32 is compressed. Also, when a pressure inside the compression chamber 32 is more than a preset pressure, a discharge valve 90 of the discharge valve assembly 40 is opened and thereby the compressed fluid is discharged to outside through the discharge pipe 4.

Operation of the suction valve 70 will be explained as follows. The suction valve 70 is rotated and linearly-moved by the pressure inside the compression chamber 32, so that the open/close portion 74 of the suction valve 70 is adhered to the one side surface 66 where the suction hole 54 of the valve supporting body 60 is formed and the outer circumferential surface of the suction valve 70 is in surface-contact with the valve seat portion 82 formed at the piston 30 thus to seal the suction hole 54.

Effects of the reciprocating compressor according to the present invention will be explained as follows.

In the suction valve assembly of the reciprocating compressor according to the present invention, the suction valve is rotated on the basis of the slot into which the hinge pin has been inserted and is linearly-moved along the slot,

thereby opening/closing the suction hole. According to this, even if the suction valve performs the open/close operation continuously, a transformation or a damage due to a fatigue can be prevented thus to enhance a reliability of the product.

Also, the stopping portion of the suction valve is stopped by the stopper formed at the valve supporting body when the suction valve is opened thus to restrict the opening angle of the suction valve, so that the damage of the suction valve due to excessive openings is prevented, a responsiveness of the suction valve is enhanced, and noise and vibration generated at the time of operating the suction valve are minimized.

Additionally, since the front surface of the suction valve constituting a part of the compression chamber is formed as a plane, a dead volume inside the compression chamber is minimized.

As the present invention may be embodied in several forms without departing from the spirit or essential characteristics thereof, it should also be understood that the above-described embodiments are not limited by any of the details of the foregoing description, unless otherwise specified, but rather should be construed broadly within its spirit and scope as defined in the appended claims, and therefore all changes and modifications that fall within the metes and bounds of the claims, or equivalence of such metes and bounds are therefore intended to be embraced by the appended claims.